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TRANSACTIONS
OF
THE NEW YORK ACADEMY OF SCIENCES

Editor
ROY WALDO MINER

Associate Editor
JAMES A. GOODE

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Executive Director: EUNICE THOMAS MINER

UNIVERSITY OF MICHIGAN

REPORT OF THE ANNUAL MEETING

December 5, 1951

The 134th Annual Meeting of the Academy, for the election of Officers and Fellows, the presentation of reports, and the transaction of other business, was held at the Waldorf-Astoria Hotel on the evening of Wednesday, December 5, 1951.

The first order of business was devoted to the reports of the Officers and Committees of the Academy.

REPORTS OF OFFICERS AND COMMITTEES

Report of the Recording Secretary. The most outstanding feature of the past year is, without doubt, the greatly extended usefulness of the Academy and of its Building, as a meeting place for scientific gatherings thus further emphasizing its function as a Science Center.

The Academy itself held sixty-five Sectional Meetings and six conferences. Two special receptions were held: one in honor of President Gibbons; the other to give a special welcome to the Foreign Delegates and Members of the International Union of Pure and Applied Chemistry, during their meeting with the XII International Congress of Pure and Applied Chemistry.

The facilities of the Building were also extended to seventeen other Societies which held a total of eighty-two meetings. This makes a grand total of 148 meetings held in our halls during the past year. The Academy provided outside auditoria for five of the conferences because of the large attendance drawn by them although their social activities were held in the Academy Building. An extremely conservative estimate of the total attendance at these meetings approximated 12,500 persons.

The Council recognized the request of a group of ladies, including the women Members of the Academy and the wives of Members, to establish an association to be known as the Women's Auxiliary of The New Academy of Sciences, with the object of aiding the Academy in obtaining the means to further furnish and equip its Building, in developing its social activities and in the encouragement of its expansion program. This association has been developed with enthusiasm under a well set-up framework as expressed in its By-Laws, with the result that under the leadership of its Governing Board an active program has been developed and the ladies have already been of great practical value to the Academy having made two generous contributions to its equipment funds. One of the special features held under the auspices of the Women's Auxiliary was a reception to Mrs. Boris Pregel, noted artist, to unveil her gift of a beautiful painting appropriate to the activities of the Academy.

Grateful acknowledgement is extended to the Officers and Members of the Academy for their energetic endeavors and generous support to the many activities of the Academy during the past year, as well as to the Chairmen and speakers at the various conferences and meetings. The 203 important scientific papers presented have contributed greatly to the progress and significance of the Academy in furthering its position as a forum for the presentation of scientific research and as the basis for its publications.

The following six conferences have been held since the previous Annual Meeting:

"The Influence of Hormones on Enzymes," Co-Chairmen, Ralph I. Dorfman, The Worcester Foundation for Experimental Biology, Shrewsbury, Massachusetts, and Eli D. Goldsmith, New York University, College of Dentistry, New York, New York.

"Curare and Anti-Curare Agents," Chairman, John A. Aeschlimann, Hoffmann-La Roche, Nutley, New Jersey.

"World Population Problems and Birth Control," Chairman, Carl G. Hartman, Ortho Research Foundation, Raritan, New Jersey.

"Microwave Spectroscopy," Chairman, Benjamin P. Dailey, Department of Chemistry, Columbia University, New York, New York.

"Viruses as Causative Agents in Cancer," Chairman, C. P. Rhoads, Director, Sloan-Kettering Institute for Cancer Research, New York, New York.

"Shock Syndrome," Chairman, John Scudder, The Presbyterian Hospital, Columbia-Presbyterian Medical Center, New York, New York.

A seventh conference will be held on December 7 and 8, 1951, upon the subject of "The Chick Embryo in Biological Research," under the Co-Chairmanship of David A. Karnofsky, Sloan-Kettering Institute for Cancer Research, New York, New York, and Mary E. Rawles, The Johns Hopkins University, Baltimore, Maryland.

The Academy hereby expresses its sincere thanks and appreciation to The Damon Runyon Memorial Fund for Cancer Research, Incorporated, for two generous grants of $7,000 each, to underwrite the expenses of the conference and the resulting publication of "Viruses as Causative Agents in Cancer," and "The Chick Embryo in Biological Research."

The Academy has continued to expand its Membership to a significant degree. During the past year, 1,398 new Members were added to our rolls, as follows: 10 Honorary Life Members, 1 Corporation Member, 9 Active Life Members, 144 Sustaining Members, 1,203, Annual Active Members, and 37 Student Members, besides 20 reinstatements. Five Annual Members were transferred to Life Membership by payment of the Life Membership fee. Twenty-three transfers were effected in the Annual Classes.

The Academy lost by death 3 Honorary Life Members, 4 Active Life Members, 8 Sustaining Members and 17 Annual Active Members. One hundred and fifty-five resignations were accepted and 132 names were dropped as not having paid dues or for not having qualified for Membership.

The Academy now stands with a net gain of 1,099 Members. There are, at present, upon the rolls of the Academy 6,536 Members, of whom 780 are Fellows, classified as follows: 3 Benefactors; 3 Patrons; 63 Honorary Life Members; 373 Active Life Members; 329 Annual Sustaining Members; 5,632 Annual Active Members; 129 Annual Student Members; and 4 Corporation Members.

Record is made with regret of the loss by death of the following Members:

Theodore J. Abbott, elected to Active Membership 5 April, 1937; died March, 1951.
Alfred J. Ackermann, elected to Active Membership 5 February, 1940; died 18 July, 1950.
William C. Bainbridge, elected to Active Membership 27 April, 1944; died July, 1950.
William Brown Bell, elected to Active Membership 21 November, 1946; died 20 December, 1950.
Clarence F. G. Brown, elected to Associate Membership 3 April, 1939; transferred to Active Membership 22 January, 1948; died, November 1950.
William H. Buschke, elected to Active Membership 27 March, 1947; died December, 1950.
A. Benson Cannon, elected to Active Membership 13 June, 1939; died 27 November, 1950.
Eugene H. Eisling, elected to Sustaining Membership 4 March, 1940; died 29 March, 1950.
Margaret C. Ferguson, elected to Active Membership 22 May, 1950; transferred to Life Membership 13 May, 1949; died 28 August, 1951. Fellow.
Walter H. Flood, elected to Active Membership 19 December, 1941; died 25 April, 1951.
Jesse M. Greenman, elected to Active Membership 22 May, 1940; died 20 January, 1951. Fellow.
Edward Bellamy Gresser, elected to Active Membership 5 April, 1937; transferred to Life Membership 27 January, 1949; died 29 April, 1951. Fellow.
Joseph Gardner Hopkins, elected to Active Membership 23 October, 1947; transferred to Sustaining Membership 25 January, 1951; died 27 February, 1951.
John R. Loofbourow, elected to Active Membership 7 April, 1941; died 22 January, 1951. Fellow.
James E. Mills, elected to Active Membership 3 March, 1941; died November, 1950.
Robert Bodley Miner, elected to Active Membership 29 November, 1945; died 3 April, 1951.
A. Cressy Morrison, elected to Active Membership 2 October, 1916; transferred to Life Membership 26 January, 1950; died 9 January, 1951. Served as President 1937–1938. Fellow.
William C. Osborn, elected to Sustaining Membership 3 April, 1905; died 3 January, 1951.
Ray A. Patelski, elected to Active Membership 26 January, 1950; died 7 September, 1951.
Jerry C. Price, elected to Life Membership 13 September, 1946; died September, 1950.
Miriam C. Pritchard, elected to Active Membership 7 April, 1941; died 9 December, 1950.
Walter Rautenstrauch, elected to Sustaining Membership 2 October, 1916; died 5 January, 1951. Fellow.
E. Aloys Rey, elected to Active Membership 14 July, 1950; died January, 1951.
Robert R. Sealock, elected to Sustaining Membership 15 August, 1951; died August, 1951.
George M. Smith, elected to Sustaining Membership 27 October, 1949; died 26 February, 1951.
Walter W. Thomson, elected to Associate Membership 7 October, 1940; transferred to Active Membership 16 August, 1948; died May, 1951.
Johan H. W. Van Ophuijsen, elected to Sustaining Membership 23 March, 1950; died May, 1950.
A. Emerson Warren, elected to Associate Membership 6 November, 1939; transferred to Active Membership 21 November, 1946; died 6 January, 1951.
Francis C. Wood, elected to Life Membership 6 April, 1925; died 5 January, 1951. Fellow.

Report of the Corresponding Secretary. There are, at present, upon the rolls of the Academy, 63 Honorary Life Members. The Corresponding Secretary takes this opportunity of presenting Members of the Academy with an up-to-date list of the Honorary Life Membership Class:

16 March, 1951.	
William T. Astbury	Leeds, England
Oswald T. Avery	Nashville, Tennessee
Charles H. Best	Toronto, Canada
V. Bjerknes	Oslo, Norway
Niels Bohr	Copenhagen, Denmark
Henri Breuil	Paris, France
MacFarlane Burnet	Victoria, Australia
Maurice Caullery	Paris, France
Hans Cloos	Bonn, Germany
James B. Collip	London, Canada
Arthur H. Compton	St. Louis, Missouri
Edwin G. Conklin	Princeton, New Jersey
Eduardo Cruz-Coke	Santiago, Chile
Henry Dale	London, England
Thomas Dalling	London, England
Clinton J. Davisson	Charlottesville, Virginia
Peter J. W. Debye	Ithaca, New York
Pierre T. De Chardin	Paris, France
Albert Defant	Innsbruck, Austria
Jack C. Drummond	Nottingham, England
Alexander Fleming	London, England
Howard W. Florey	Oxford, England
Ross G. Harrison	New Haven, Connecticut
David K. Henderson	Edinburgh, Scotland
Ludwik Hirszfeld	Wroclaw, Poland
Bernado A. Houssay	Buenos Aires, Argentina
Julian S. Huxley	New York, New York
Harold Jeffreys	Cambridge, England
Peter Kapitza	Moscow, U.S.S.R.
Arthur Keith	Kent, England
Albert Jan Kluyver	Delft, The Netherlands
Alfred L. Kroeber	New York, New York
Hugo H. Kruyt	The Hague, Holland
Irving Langmuir	Schenectady, New York
K. S. Lashley	Orange Park, Florida
Constantin Levaditi	Paris, France
K. U. Linderstrom-Lang	Copenhagen, Denmark
Robert H. Lowie	Berkeley, California
Paul Niggli	Zurich, Switzerland
Vladimir A. Obruchev	Moscow, U.S.S.R.
Marcus L. E. Oliphant	Canberra, Australia
Charles Palache	Cambridge, Massachusetts
George H. Parker	Cambridge, Massachusetts
Charles Perez	Paris, France
Jean Piaget	Geneva, Switzerland
Henri Pieron	Paris, France
Gaston L. Ramon	Garches, France
Carl-Gustaf A. Rossby	Chicago, Illinois
John Runnstrom	Stockholm, Sweden
Henry Norris Russell	Princeton, New Jersey
Florence R. Sabin	Denver, Colorado
Nevil W. Sidgwick	Oxford, England
Erik A. Stensio	Stockholm, Sweden
Th. Svedberg	Uppsala, Sweden
Harold U. Sverdrup	Oslo, Norway
N. H. Swellengrebel	Amsterdam, Holland
Albert Szent-Gyorgyi	Princeton, N. J.
Arne Tiselius	Uppsala, Sweden
Johannes H. F. Umbgrove	Delft, Holland
Felix A. Vening-Meinesz	Anersfoort, The Netherlands
David M. S. Watson	London, England
R. Stefan Jan Weigl	Cracow, Poland

Record is made with regret of the loss by death of the following Honorary Life Members:

Robert Broom, Pretoria, South Africa, elected 20 December, 1935. Died, April 6, 1951.
Octave Duboscq, Paris, France, elected 21 December, 1936. Died, 1949.
Kingo Miyabe, Sapporo, Japan, elected 21 December, 1936. Died, March 16, 1951.

Report of the Editor. During the fiscal year ending October 31, 1951, The New York Academy of Sciences has published 10 monographs, 9 of these being included in the ANNALS and 1 in THE SCIENTIFIC SURVEY OF PORTO RICO AND THE VIRGIN ISLANDS, comprising a total of 1,918 pages. Included in these are 140 papers by 166 authors. Two reprinted volume (394 pages) and the TRANSACTIONS (368 pages) bring the total pagination issued to 2,680.

The list of publications is as follows:

ANNALS

Volume 51, Article 6, "Methodology and Techniques for the Study of Animal Societies" (12 papers), by J. P. Scott *et al.* Pages 1001–1122. Published November 7, 1950.
Volume 51, Article 7, "Human Engineering" (13 papers), by L. E. Abt *et al.* Pages 1123–1278. Published January 31, 1951.
Volume 51, Article 8, "The Mechanisms of Cell Division" (16 papers), by M. J. Kopac *et al.* Pages 1279–1546. Published March 23, 1951.
Volume 53, Article 3, "The Growth, Replacement, and Types of Hair" (28 papers), by J. B. Hamilton *et al.* Pages 461–752. Published March 27, 1951.
Volume 53, Article 4, "The Fundamental Aspects of Lubrication" (14 papers), by O. A. Beeck *et al.* Pages 753–994. Published June 27, 1951.
Volume 53, Article 5, "Specific Methods of Analysis" (9 papers), by Samuel E. Q. Ashley *et al.* Pages 995–1118. Published July 20, 1951
Volume 54, Article 1, "Leprosy" (17 papers), by E. Grunberg, *et al.* Pages 1–142. Published March 30, 1951.
Volume 54, Article 2, "Papain" (11 papers), by M. L. Tainter *et al.* Pages 143–296. Published May 16, 1951.

Volume 54, Article 3, "Curare and Anti-Curare Agents" (19 papers), by K. R. Unna *et al.* Pages 297–530. Published October 30, 1951.

THE SCIENTIFIC SURVEY OF PORTO RICO. Volume XVII, Part 1, "The Pelecypoda or Bivalve Mollusks of Porto Rico and the Virgin Islands," by Richard A. McLean. Pages 1–184. Published April 11, 1951.

SECOND PRINTING, Annals, Volume 50, Article 6, "The Adrenal Cortex," by Robert Gaunt *et al.* Pages 509–678. First published June 27, 1949. Second Printing December, 1950.

SPECIAL PUBLICATIONS, Volume I, "Climate and Evolution," by William D. Matthew. Pages i–xi, 1–224. First published June 15, 1939. Second Printing December, 1950.

TRANSACTIONS, Series II, Volume 13, Numbers 1–8, consisting of 368 pages, was completed, printed, and distributed each month from November, 1950, to June, 1951, inclusive.

IN PRESS: In addition to the articles published above, the following monograph is in press and will be published before the close of the calendar year: Annals, Volume 54, Article 4, "The Influence of Hormones on Enzymes" (16 papers), by R. I. Dorfman *et al.* Pages 531–728.

From November 1, 1950, to October 31, 1951, the Academy distributed 146,067 separate publications and 12,742 complete volumes of the various series, as follows:

	Separate Numbers	*Volumes*
Annals:		
Gratis: Members	19,568	
Gratis: Authors, reviews, exchanges and Donors	6,524	77
Sales	8,520	39
Authors' Reprints	53,925	
Special Publications: (Volumes I, III, & IV)		
Gratis: Individuals and reviews		15
Sales		558
Scientific Survey of Porto Rico:		
Gratis	182	
Sales	355	23
Transactions, Series II:		
Gratis: Members, authors, exchanges, and reviews	4,907	5,838
Sales	245	104
Authors' reprints	44,650	
Monthly Programs:		
Gratis: Members, and reviews	960	6,088
Sales	6,231	
	146,067	12,742

The total cost value of publications distributed gratis to the Members, authors, donors, reviewers and exchange institutions is $53,806.93.

Report of the Treasurer. In submitting the Report of the Treasurer for the past year, I shall not dwell extensively upon the details of the trials which have faced us nor on the hurdles which we have endeavored to take in our stride. Nevertheless, it must be recognized that this has been a period of both financial struggle and achievement for the Academy.

Our finances are in good shape even though our current operating expenses have increased our deficit. A considerable portion of our financial efforts has been devoted to the need for orienting ourselves in the new Building and naturally in the strenuous endeavor we have made to bring our important publications program up-to-date. It is true that all costs have advanced but we have postponed as long as possible the necessity for raising the dues, while at the same time, we have been increasing the benefits to the Members.

Your attention is called to the sources of our income and the fact that we are entirely too dependent upon the support received from our Members and the sales of publications with which we meet the major portion of our operations.

It seems essential that every believer in our Academy and the value of its work should direct his efforts toward the enlargement of our fixed sources of income. That type of financial assistance is indispensable. Any addition along those lines would help us better to carry out our present plans and strengthen our position for the future. We need funds upon which an income may be derived to conduct our daily operations.

The Academy has been most fortunate, however, during the past year in obtaining $24,811.00 in grants to aid several of the Conferences and the publications resulting therefrom. In particular, I take great pleasure in reporting two generous grants of $7,000 each from The Damon Runyon Memorial Fund for Cancer Research, Incorporated to cover in full the expenses in connection with the Conferences on "Viruses as Causative Agents in Cancer," and on "The Chick Embryo in Biological Research," as well as grants totaling $2,000 from the Wenner-Gren Foundation for Anthropological Research, Incorporated, to further the work of Sectional Meetings and the printing of Transactions.

A number of research Corporations have also contributed to this support of our scientific program, including the publications. These encouraging gifts have been of the utmost value in helping the Academy to fulfill its aims of serving as a Science Center and providing a forum for scientific discussion.

You will find in the following pages information regarding the Academy's financial status. The books of accounting have been checked and certified by the firm of Peat, Marwick, Mitchell and Company, Certified Public Accountants. The property of the Academy has been verified by the Auditors and by the Finance Committee.

This Report has been approved by the Finance Committee as of November 29, 1951, as provided in the By-Laws.

Report of the Auditors.

PEAT, MARWICK, MITCHELL & CO.
CERTIFIED PUBLIC ACCOUNTANTS
SEVENTY PINE STREET
NEW YORK 5, N. Y.

Accountants' Report

To the Finance Committee,
The New York Academy of Sciences,
New York, N. Y.

We have examined the balance sheet of The New York Academy of Sciences as of October 31, 1951 and the related statement of income and expenses and General Fund deficit for the year then ended. Our examination was made in accordance with generally accepted auditing standards and included such tests

of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

The bank balances have been confirmed by certificate obtained directly from the depository.

We did not confirm the members' dues or the pledges receivable by communication with the respective members or pledgors. We communicated with all debtors on accounts receivable for publications by mailing the Academy's statements for the month of October accompanied by a request that we be notified of any exceptions and the exceptions reported were explained to our satisfaction. Provision has not been made for possible loss in collection of dues, pledges and accounts receivable.

The books and publications on hand at October 31, 1951 have not been reflected in the accompanying balance sheet as it is the policy of the Academy to charge to expense the publication costs as incurred.

The fund investments were inspected and the income therefrom was confirmed by reference to independent sources.

We inspected the deed to the real estate at 2 East 63rd Street, New York, contributed to the Academy in 1949. It is carried in the balance sheet at the valuation as assessed by the City of New York for real estate tax purposes as of the date of the contribution. The furniture, fixtures and equipment include furnishings contributed, to which a value of $10,000.00 has been assigned. We inspected approved vouchers in support of additions and improvements during the year. Consistent with the practice usually followed by similar organizations, the Academy does not provide for depreciation of the furniture, fixtures and equipment or of the building.

All liabilities of which we obtained knowledge in the course of our examination have received appropriate recognition.

In our opinion, the accompanying balance sheet and statement of income and expenses and General Fund deficit present fairly the financial position of The New York Academy of Sciences at October 31, 1951 and the results of its operations for the year then ended, in conformity with generally accepted accounting principles.

/s/ Peat, Marwick, Mitchell & Co.

New York, N. Y.
November 27, 1951.

THE NEW YORK ACADEMY OF SCIENCES

Balance Sheet

As of October 31, 1951

ASSETS			LIABILITIES AND FUNDS			
Cash in The Chase National Bank of the City of New York:			Accounts Payable			$ 29,376.32
General fund		$ 427.80	Mortgage on Real Estate			190,569.49
Special funds:						
Mortgage principal and interest quarterly payment		4,000.00	Members' Dues unearned for calendar year 1951 ($10,712.00) and received in advance for 1952 ($2,219.00)			12,931.00
Grants-in-Aid		20,886.78				
Contributions for furniture and fixtures		217.76	Special Funds:			
Auditorium project		100.41	Grants-in-Aid		$20,886.78	
Uninvested cash of Endowment Funds		12,865.76	Contributions for furniture and fixtures		217.76	
George Frederick Kunz Prize Fund		361.85	Auditorium project		100.41	
A. Cressy Morrison Prize Fund		554.25	Endowment and Prize Funds			
Building Fund		456.00	John James Audubon Fund	$ 2,500.00		
		39,870.61	Nathaniel Lord Britton Fund	28,938.53		
			Centennial Endowment Fund	7,934.00		
Members' Dues Receivable for calendar year 1951		2,571.00	George Frederick Kunz Prize Fund	1,361.85*		
Building Fund Pledges Receivable		3,175.00	A. Cressy Morrison Prize Fund	11,091.76*		
Accounts Receivable for Publications		2,881.11	John Strong Newberry Fund	1,000.00		
Interest Receivable		6.76	Publication Fund	3,027.00		
Prepaid Expenses		348.73	George Herbert Sherwood Fund	7,000.00		
Fund Investments—Stocks and Bonds:			Ralph H. Tower Fund	12,728.00		
Endowment and Prize Funds—stated at purchased cost or quoted price at date of contribution (quoted market value at October 31, 1951, $74,100.50)	$53,889.77		Net gain on sale of investments	2,090.49	77,671.63	98,876.58
			Building Fund:			
			Balance as of October 31, 1950		266,194.32	
			Gain on sale of investments		13,669.30	

* Includes income for prizes.

Building Fund—stated at purchased cost (quoted market value at October 31, 1951, $4,236.50)	3,886.13	57,775.90
Real Estate, Furniture, Fixtures and Equipment:		
Real estate at 2 East 63rd Street, New York, at assessed valuation at date of contribution, and improvements at cost:		
Land	200,000.00	
Building	225,000.00	
Improvements	27,280.63	
	452,280.63	
Furniture, fixtures and equipment—comprising contributed furnishings at assigned value of $10,000.00 and balance at cost	25,979.34	478.259.97
		584,889.08
Transfers between Funds, per contra		13,630.39
		$598,519.47

Cost of furniture, fixtures and equipment transferred from General Fund	1,674.32	
Unused balance of allowance for doubtful pledges provided in prior year	1,055.00	
Balance as of October 31, 1951		282,592.94
General Fund Deficit, per accompanying statement		(29,457.25)
		584,889.08
Transfers between Funds:		
Indebtedness of General Fund to Endowment and Prize Funds	10,000.00	
Advances by General Fund to Building Fund	3,630.39	
		13,630.39
		$598,519.47

THE NEW YORK ACADEMY OF SCIENCES

Statement of Income and Expenses and General Fund Deficit

For the Year ended October 31, 1951

GENERAL FUND

Income:		
Membership dues		$62,370.83
Sales of publications		35,364.32
Contributions		6,032.70
Income from securities of Endowment Funds		3,495.20
Sales of tickets for conferences and annual dinner		2,574.75
Reimbursement for use of meeting rooms and office space		2,828.64
		112,666.44
Expenses:		
Publication costs (exclusive of costs charged to Grants-in-Aid)	39,869.14	
Distribution of publications—salaries and expenses	12,294.46	
Postage	7,841.23	
Conferences and sectional meeting expenses	7,587.57	
Salaries of editorial staff	7,270.24	
Membership expansion—salaries and expenses	6,313.54	
Public relations salaries and expenses	4,110.63	
Annual dinner and meeting expenses	1,786.47	
Telephone	1,362.94	
Accounting Fee	750.00	
Insurance	571.11	
General office salaries and expenses	23,937.68	113,695.01
Excess of Expenses over Income		1,028.57
Deficit as of October 31, 1950		10,883.17
Furniture, Fixtures and Equipment, at cost, transferred to Building Fund		1,674.32
Excess of Expenses over Income of Building Fund (as below)		18,856.08
		32,442.14
Deduct:		
Publication cost of "Medical Mycology" incurred in prior year, transferred to Grants-in-Aid	1,422.63	
Balance of Sustaining Fund transferred to General Fund	1,000.00	
Unused balance of allowances for doubtful dues and accounts receivable provided in prior year	562.26	2,984.89
Deficit as of October 31, 1951		$29,457.25

BUILDING FUND INCOME AND EXPENSES

Income:		
Contributions		$2,971.21
Income from securities		2,157.76
		5,128.97
Expenses:		
Building operating salaries and expenses	$15,330.61	
Interest on mortgage	8,654.44	
		23,985.05
Excess of Expenses over Income—transferred to General Fund Deficit (as above)		$18,856.08

AWARDS OF PRIZES

Two Prizes of $200 each in the A. Cressy Morrison Prize Competition in Natural Science were offered for the year 1951.

Ten papers were entered in competition this year. After careful comparison and discussion of the relative merits of the papers presented, the Committee, as authorized by the Council, makes the following awards:

(1) A prize of $200 to the paper entitled "Direct Evidence for the Multiplication of Aster-Yellows Virus in Its Insect Vector," by Karl Maramorosch, Rockefeller Institute for Medical Research, New York, New York.

(2) A prize of $200 to the paper entitled "Studies on Cell Differentiation. Auxin as the Hormonal Factor Normally Limiting the Differentiation of Xylem Cells Around a Wound," by William P. Jacobs, Assistant Professor of Biology, Princeton University, Princeton, New Jersey.

(3) Honorable Mention to the paper entitled "Ionic Transfer in Nerve in Relation to Bioelectrical Phenomena," by Abraham M. Shanes, Section on Pharmacology and Toxicology, National Institute of Arthritis and Metabolic Diseases, Bethesda, Maryland.

ELECTION OF FELLOWS AND HONORARY LIFE MEMBERS

The following Members were elected to Fellowship:

Abelson, Philip H., Ph.D.
Allen, Mary Belle, Ph.D.
Amdur, Isadore, Ph.D.
Andrus, E. Cowles, D.Sc.
Angel, J. Lawrence, Ph.D.
Appelbaum, Emanuel, M.D.
Aub, Joseph C., M.D.
Bartlett, Paul D., Ph.D.
Bauer, Louis Hopewell, M.D.
Beecher, Henry K., M.D.
Beers, Roland F., M.S.
Bercovitz, Z. T., M.D.
Berens, Conrad, M.D.
Bikerman, Jacob J.
Bogert, Marston T., LL.D.
Calvin, Melvin, Ph.D.
Carlson, Gustaf H., Ph.D.
Conner, Robert T., Ph.D.
Cross, Paul C., Ph.D.
Davidson, Kenneth S.M., D.Sc.
De Jonge, A. E. Richard
Denstedt, Orville Frederick, Ph.D.
Djerassi, Carl, Ph.D.
Doering, William, Ph.D.
Dunnington, John Hughes, M.D.
Durham, E. J., Ph.D.
Eby, J. Brian, Ph.D.
Eirich, Frederick R., Ph.D.
Elman, Robert, M.D., M.S.
Feld, Jacob, Ph.D.
Feodoroff, Nicholas V., C.E.
Fevold, Harry L., Ph.D.
Field, Henry, D.Sc.
Fischer, Herman, O.L., Ph.D.
Golden, Ross., M.D.
Grafflin, Allan L., M.D
Haig, Charles, Ph.D.
Hampel, Chester W., Ph.D.
Harris, Milton, Ph.D.
Hasselstrom, Torsten, D.Sc.
Hassid, William Z., Ph.D.
Hegnauer, Albert H., Ph.D.
Herbst, Robert M., Ph.D.
Hober, Rudolf, M.D.
Hockett, Robert Casad, Ph.D.
Hodge, Harold C., Ph.D.
Hoster, Herman A., M.D.
Howes, Edward Lee, M.D.
Humphrey, Rufus R., Ph.D.
Hyden, Holger, M.D.
Jonnard, Raymond, D.Sc.
Kaplan, Ira I., M.D.
Katchalski, Ephraim, Ph.D.
Keefer, Chester S., M.D.
Kesten, Beatrice M., M.D.
Keyes, Donald B., Ph.D.
Korvin-Kroukovsky, Boris V., M.S.
Krayer, Otto, M.D.
Laidler, Keith J., Ph.D.
Levy, Robert L., M.D.
Light, Amos E., M.A.
Lilienthal, Jr., Joseph L., M.D.
Littauer, Sebastian B., D.Sc.
McLaren, A. Douglas, Ph.D.
MacPhillamy, Harold B., Ph.D.
Marble, John Putnam, Ph.D.
Mirsky, I. Arthur, M.D.
Most, Harry, M.D.
Nelson, Warren O., Ph.D.
Oppenheimer, Bernard S., M.D.
Petermann, Mary Locke, Ph.D.
Pregel, Boris, Ph.D.
Rado, Sandor, M.D.
Rahn, Hermann, Ph.D.
Rausch, Robert, Ph.D.
Ravdin, I. S., Surgery, M.D.
Regna, Peter P., Ph.D.
Robb, Jane Sands, M.D.
Salisbury, Edward I., M.D.
Schales, Otto, D.Sc.
Sendroy, Jr., Julius, Ph.D.
Shapiro, Harry H., D.D.D.
Shewhart, Walter A., Ph.D.
Smith, Christianna, Ph.D.
Squire, Edward J., M.S.
Stavely, Homer E., Ph.D.
Stetten, Jr., De Witt, Ph.D.
Stock, C. Chester, Ph.D.
Sturtevant, Julian M., Ph.D.
Suter, C.M., Ph.D.
Trager, William , Ph.D.
Trillat, J. J., Ph.D.
Varlan, Gaston, Ph.D.
Waelsch, Heinrich, Ph.D.
Weiss, Joseph, Ph.D.
Wenrich, D.H., Ph.D.
Woody, McIver, M.D.
Work, Harold K., Ph.D.
Zirkle, Raymond E., Ph.D.

Honorary Life Membership was conferred upon the following eminent scientists:

M. Albert Caquot, Engineering, President Elect of the International Academy of France.
Henrique da Rocha Lima, M.D., Biology, Director-Emeritus of the Biological Institute, Sao Paulo, Brazil.
Wilhelm Schmidt Anthropology, Director, Anthropos Institut, Switzerland.

ELECTION OF OFFICERS

The following officers were elected for the year 1952:

President
GEORGE B. PEGRAM

Vice-Presidents
JOHN RAY DUNNING PAUL FEJOS

Chairmen of Sections
SIDNEY PAIGE CHARLES O. BECKMANN
CHARLES W. MUSHETT WILLIAM L. DONN
ZYGMUNT A. PIOTROWSKI ABRAHAM SLAVIN
A. L. KROEBER

Chairmen of Division
BENJAMIN M. DUGGAR

Recording Secretary
JOHN TEE-VAN

Corresponding Secretary
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DONALD M. BENJAMIN

Editor
ROY WALDO MINER

Councilors (1952–1954)
WILLIAM H. COLE CLIFFORD J. RASSWEILER
MAURICE L. TAINTER

Finance Committee
ROBERT F. LIGHT, *Chairman* GORDON Y. BILLARD
HARDEN F. TAYLOR

PROGRAM OF THE EVENING

After the Business Meeting, the following program was given:
Synthetic Rubber. Willis A. Gibbons, Retiring President, New York Academy of Sciences.
Atomic Energy Comes of Age. John Ray Dunning, Dean, School of Engineering, Columbia University, New York, N. Y.

ATOMIC ENERGY COMES OF AGE

By JOHN RAY DUNNING

Dean, School of Engineering,
Columbia University, New York, N. Y.

The impact of the development of the atom bomb has been felt all over the world, even though the places where the bomb has been exploded were just names with little meaning for many persons prior to July, 1945. To most people, atomic energy has meant simply the destruction of the human race. A few with imagination have begun to predict an entirely new world where man can recreate, reshape and master every limited prevailing condition or situation. To the scientists in the various laboratories throughout the world, who had been patiently working with atomic energy for the past 50 years at least, the development of the atomic bomb was the realization of a phase of the unprecedented progress that had been made. Instead of prophecy, the scientists working with atomic energy are assessing the major steps which have been taken and probable future trends.

The scientists is never satisfied, although he digs deeper and deeper into phenomena in a continuing effort toward a more detailed understanding. In many fields, however, long before we have even a rough picture of what is happening, it is nevertheless possible to make practical use of phenomena and processes. Long before a detailed comprehension of nuclear forces was achieved, we were able to utilize nuclear energy. For decades, the intrinsic energy available in matter has been understood implicitly. More than ten years before 1939, the exothermic and endothermic character of the "energy of arrangement," or binding energy changes in typical nuclear reactions, was thoroughly understood in essence.

The landmarks along the way in the development of atomic energy were the concepts of John Dalton, Thomas Boyle, Avogadro, Mendeleeff; the kinetic theory of gases and radiation by Maxwell, Boltzman, Planck, and others in the last century laid a solid foundation. Just prior to the turn of the century (1895-1900), the work on electromagnetic radiation by Hertz and Maxwell was being put to practical use by Marconi and others. In Germany, Roentgen discovered the X rays and provided a new tool for medical diagnosis and therapy which became a new method for the physicist in exploring the structure of matter and the interior of atoms. In England, Thompson and others were beginning to take apart the atom, and established the fact that a new particle, the electron, was a fundamental building unit of all atoms. In that same period in France, Becquerel discovered the natural radioactivity of uranium minerals and, followed by the Curies and many others, opened a new field, nuclear physics, which was to become the study of the atomic nucleus.

Rutherford made a major step forward when he fired alpha particles (high-speed stripped helium atoms from natural radioactive elements) at thin gold foils and discovered, from the way the alpha particles were scattered or "bounced," that virtually all of the mass of an atom is concentrated in a tiny central core less than one ten-thousandth the diameter of the whole atom.

The modern concept of the nuclear atom again made great progress when Bohr first combined Newton's mechanics with Planck's quantum hypothesis and gave us what may be called crudely the solar system atom. The Rutherford-Bohr atom postulated a tiny, positively charged, central sun, or nucleus, surrounded by one or more negative electrons which revolve much like planets around the sun. Energy changes, however, could occur only in definite amounts. Bohr's quantum mechanics was remarkably successful in explaining the discrete sharp spectral lines emitted by the hydrogen atom when it is excited in an electrical discharge.

This early atom model has been extended through the work of Heisenberg, Schödinger, Pauli, and others, on the more mathematical bases of matrix mechanics and wave mechanics. I believe it is safe to say that, where present-day quantum mechanics has been applied carefully, all phenomena in nature outside the atomic nucleus, *i.e.*, molecular spectra, radiation processes,

electricity and magnetism, molecular phenomena, chemical reactions, *etc.*, appear to be satisfactorily "explained." The physicists emphasize that our present "explanations" do not represent ultimate reality; they represent the logical quantitative descriptions in terms of the special language adopted.

The building stones of the nucleus appear to be the proton and the neutron, usually called nucleons. Although we now know that there are more neutrons than anything else in the world, they were recognized only in 1932, when the neutron was conclusively identified by Chadwick.

The availability of radio-isotopes of almost every element has given a new tool to many fields. The development of the Geiger counter into a standard instrument makes possible detection of single radioactive atoms. By mixing a tiny fraction of radioactive isotopes with stable ones, from which they are chemically indistinguishable, the dynamics of almost any process may be followed quantitatively and in detail. In physics and chemistry, metallurgy and industrial processes, and especially the biological fields and medicine, the radioactive tracers permit us to label almost any atom or compound and follow it.

The history of research until now has always shown that as we develop new techniques we progress into new realms; from macroscopic matter to atoms, to the inner structure of the atom, to the nucleus, to the particles of the nucleus, and so on. One wonders if this is always to be the case; that new worlds lie below. Nuclear physics is going in the reverse direction from astronomy, where with each larger telescope, reaching farther out into space, new worlds are seen, and cosmologists debate whether the universe is finite and bounded, or infinite. As we step off into these new realms, now into the hundred million volt meson mass range, and then some few years later into the billion volt neutron-proton realm, no one can predict what new secrets of matter and energy will unfold. At present, with uranium fission we convert only 1/1000 of the mass into energy, so we have a possible factor of 1000 to gain. However, we are not promising to discover new and better atomic bombs, or even new and better power sources. We do, nevertheless, have every confidence that future knowledge will open up new avenues of thought that will be reflected in many aspects of human activity.

A good beginning has been made, in such fields as cancer, in the application of isotopes to therapy. While medical groups may be conservative as to preferential therapeutic effects of radioisotopes, as compared with whole body radiation with X-rays for leukemia control (not cure), radioisotope therapy seems at least as successful and much simpler, with no appreciable after effects. Similarly, in certain types of thyroid cancer and hyperthyroidism, radioiodine has within the last year proved promising. It can certainly be conservatively stated that techniques employing radioactive isotopes provide new tools whose applications to many fields will bring new knowledge and new methods, the future uses of which we can at best only dimly forsee.

What are the future possibilities for large-scale utilization of nuclear power? This is not an easy question to answer and, indeed, cannot be fully answered at this time because there is not enough data of experience available. We have a complex series of interdependent factors: raw material availability and costs, fissionable material production costs, as yet incompletely known scientific and engineering questions on nuclear processes, materials of construction, engineering designs, capital investment, maintenance and operating costs, and many more.

While some interesting long-range possibilities exist for the conversion of fission fragment energies in part directly into electrical energy, all practical methods for nuclear energy utilization considered feasible in the immediate future involve degradation of nuclear energy into heat; and transfer of the heat to some working fluid, in one or more steps, either to some process heat application or to some more or less conventional prime mover such as a steam or gas turbine.

The initial phases of nuclear development were largely scientific in character. We are now entering a new phase. If large-scale utilization of power is to be achieved, not only must the nuclear scientists contribute, but the metallurgists, chemical engineers, mechanical engineers, electrical engineers, and especially the process engineers, must work together. To be successful, future nuclear reactor power plants must represent, probably more than any other type of undertaking, an integrated approach by all these diverse skills and fields of knowledge.

An utopia will certainly not result even from zero-cost fuel. At least, with nuclear power plants costing initially somewhat more, with the degree of success of "breeding" new fuels by conversion of U-238 and thorium still uncertain, with comparative operating and maintenance costs yet to be determined, no one today can possible give a reliable comparative cost-analysis of future nuclear power.

With further development over 10 to 25 years, with gradual simplification of nuclear plants, and possibly with the use of more efficient heat-engine methods which exploit the enormous temperatures possible with nuclear energy, the balance may shift more favorably to nuclear energy.

ABSTRACTS OF PRIZE-WINNING PAPERS

DIRECT EVIDENCE FOR THE MULTIPLICATION OF ASTER-YELLOWS VIRUS IN ITS INSECT VECTOR

By KARL MARAMOROSCH*

Awarded an A. Cressy Morrison Prize, 1951

Aster yellows is a plant disease caused by the aster-yellows virus. It is transmitted from plant to plant by the aster leafhopper. This insect may become infective through feeding on a diseased plant, or mechanically by receiving an injection of juices from leafhoppers that had fed on on adiseased plant some days previously. The mechanical inoculation was used for a serial passage of the virus through 10 groups of insects. At each transfer measured volumes of 1/8000 cc. per insect were injected into the abdominal cavity and the insects kept for 30 days without access to fresh virus. The survivors were macerated and the juices from them diluted with a salt solution to

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1:1000 and centrifuged. The supernatant was used for the injection of the next group. In this way the virus was transmitted to the 10th group. Thus new and direct evidence that this plant virus multiplies in its insect vector was obtained, confirming earlier findings. The estimated dilution, used to inoculate the 10th group of the series, if no multiplication had occurred, would have reached 10^{-40} or one part in many, many billions. Since viruses multiply only inside of living cells, and leafhoppers do not take up living plant cells, the multiplication must have occurred in cells of the insect. A comparison of virus concentration in the inoculum of the first and ninth group showed no decrease in concentration. It is concluded that since the aster-yellows virus multiplies in both its plant and insect host, it can be considered an animal as well as a plant virus.

STUDIES ON CELL DIFFERENTIATION, AUXIN AS THE HORMONAL FACTOR LIMITING THE DIFFERENTIATION OF XYLEM CELLS AROUND A WOUND

By WILLIAM P. JACOBS*

Awarded an A. Cressy Morrison Prize, 1951

As a living organism grows from a single cell to a large plant or animal with hundreds of thousands of cells, the various cells produced become specialized or differentiated. For instance, some cells of the animal differentiate into muscle cells, others into blood cells, and some cells of the plant turn into leaf cells, others into water carrying cells (or Xylem cells, as they are called). These experiments show by a variety of methods that the differentiation of the Xylem cell is controlled by a known hormone, formed in the leaves of the growing plant and moving down into the stem where it causes an unspecialized cell type to be converted to Xylem cells. This hormone in synthetic form at the same concentration as is produced by the leaves can completely replace the effect of the leaves in causing the differentiation of these Xylem cells.

* Department of Biology, Princeton University, Princeton, New Jersey.

THE NEW YORK ACADEMY OF SCIENCES

announces

FOUR PRIZE CONTESTS FOR 1952

The New York Academy of Sciences announces the following prize contests for the coming year:

I. THE A. CRESSY MORRISON PRIZE COMPETITION IN NATURAL SCIENCE

Two prizes of $200 each are offered for the two most acceptable papers entered in competition, in a field of natural science covered by the Academy and its Affiliated Societies. This is made possible by the establishment in 1949 of the A. Cressy Morrison Prize Fund. Announcement of the Awards will be made at the Annual Meeting of the Academy to be held in December, 1952.

II. THE A. CRESSY MORRISON ASTROPHYSICAL PRIZE

The Academy was saddened by the death of Mr. Morrison in January, 1951. His high regard for the Academy, which he served for many years in various capacities on the Council and finally as President, and also through his continued generosity in annual grants for the justly famous A. Cressy Morrison Prizes, received a final expression in a bequest in his will of a substantial addition to the A. Cressy Morrison Prize Fund. This enlargement of the Fund makes possible, at intervals, the offer by the Academy of an Astronomical Prize. During 1952, this will take the form of a Prize of $500 for the most acceptable paper in the field of nuclear reactions in astrophysical processes. Announcement of the award of this prize will be made at the Annual Meeting of the Academy in December 1952.

III. THE GEORGE FREDERICK KUNZ PRIZE CONTEST IN GEOLOGY AND MINERALOGY

A prize of $200, offered in accordance with the bequest of the late Doctor George Frederick Kunz, will be awarded at the Annual Meeting, December, 1952, for the most acceptable paper in the field of Geology and/or Mineralogy.

IV. THE BORIS PREGEL PRIZE ON NATURAL RADIOACTIVE SUBSTANCES

Through the generosity of Doctor Boris Pregel a prize of $200 is offered for the most acceptable paper embodying the results of research in the field of natural radioactive substances received in competition during the year 1952. The award of this prize will be announced at the Annual Meeting of the Academy to be held in December, 1952.

More explicit details and the conditions governing these competitions will be published by the Academy in the February, 1952, issue of the TRANSACTIONS, Volume 14, Number 4, and will be distributed to all members. A pamphlet embodying these terms will also be available for all persons entitled to compete for these prizes.

*SECTION OF BIOLOGY**

SYMPOSIUM ON STREPTOCOCCAL ENZYMES: A STREPTOCOCCAL PROTEINASE AND ITS PRECURSOR†

By STUART D. ELLIOTT‡

Grown under certain conditions, some group A streptococci lose their type-specific protein antigen (M substance). This antigenic loss is temporary, and results from proteolytic activity in the bacterial culture during the later stages of growth. The proteinase is an extracellular product of the streptococcus. It resembles papain in that it achieves maximal activity in the presence of SH compounds or cyanide and is irreversibly inactivated by iodoacetate. The enzyme is derived from an inactive precursor present in culture filtrates of proteolytic streptococci. The precursor is converted to the active enzyme by autocatalysis during the later stages of bacterial growth, or by the action of trypsin.

Both precursor and active enzyme have been isolated in crystalline form by treatment with ammonium sulfate of suitably concentrated preparations. The two proteins may be distinguished, one from the other, on the basis of biological activity, solubility, electrophoretic mobility, and immunological specificity.

For proteinase production by group A streptococci, the following conditions must be satisfied:

(1) A "competent" streptococcus; mouse virulent strains are not proteolytic and non-proteolytic variants may be obtained from proteolytic streptococci by passage through mice, until a high degree of virulence is achieved.

(2) Growth in liquid medium at pH 5.5 to 6.5.

(3) The presence of at least two factors in the culture medium. One of these is tryptophane; the other, at present unidentified, is found in enzymatic digests of casein. A dialysable substance with properties similar to those of the casein factor has been found in precursor preparations which have been converted autocatalytically to the active enzyme by incubation in the presence of cysteine.

* A paper by G. E. Hutchinson, entitled "The Cycles of Atmospheric Gases," was presented at a meeting of the Section of Geology and Mineralogy, December 3, 1951.

A paper by William Von E. Doering, entitled "The Chemistry of Tropolone," was presented at a meeting of the Section of Physics and Chemistry, December 4, 1951. No abstracts of these papers have been received.

† This paper was presented as the first of five papers in the Symposium on Streptococcal Enzymes held by the Section of Biology on December 10, 1951.

‡ Rockefeller Institute for Medical Research, New York, N. Y.

Supported by a grant from the Helen Hay Whitney Foundation.

ELABORATION AND INHIBITION OF STREPTOCOCCAL DESOXYRIBONUCLEASE*

By ALAN W. BERNHEIMER†

It has become increasingly evident that streptococci belonging to Lancefield Group A are capable of producing, during growth, a considerable variety of extracellular toxins and enzymes. Among the most recently discovered is desoxyribonuclease, an enzyme shown, independently, to be a product of streptococcal growth by McCarty[1] and by Tillett, Sherry and Christensen.[2]

In contrast to observations made on growing cultures, it has been found[3] that washed streptococcal cells yield significant amounts of desoxyribonuclease when suspended in a very simple solution which is incapable of supporting growth. For the appearance of the enzyme in the suspending solution only an energy source, *e.g.*, glucose or maltose, magnesium ions and a phosphate buffer are required. No enzyme is elaborated if but one of these components is omitted from the suspending solution. The addition of any of a variety of amino acids and vitamins failed to increase the amount of enzyme appearing, as did the addition of desoxyribonucleate; indicating, in agreement with earlier observations[1], that formation of desoxyribonuclease is not adaptive.

The observations just described could be explained by assuming that the enzyme exists in a pre-formed state within the streptococcal cells, and that it is simply released from the washed cells when they are placed in a suitable environment. Experiments were carried out involving physical disruption of the cells under conditions which do not destroy the enzyme, and the results indicate that the desoxyribonuclease is not present in a preformed state. This finding, coupled with observations that elaboration of the enzyme is inhibited by a variety of metabolic poisons, *e.g.*, fluoride, iodoacetate, mercuric ion and 2,4-dinitrophenol, suggest that the enzyme is being synthesized in the streptococcal cells.

Extracts prepared from sonically disrupted cocci partially inhibit the depolymerase activity of desoxyribonuclease formed by Group A strepto-

* This paper was presented as the second of five papers in the Symposium on Streptococcal Enzymes held by the Section of Biology on December 10, 1951.

† Department of Microbiology, New York University College of Medicine, New York.

cocci.[2] A striking characteristic of the inhibitor is its specificity, for although it inhibits the desoxyribonuclease of Group A streptococci, it fails to inhibit desoxyribonucleases prepared from pancreas, barley, or even those produced by streptococci belonging to Groups B and C. The Group A enzyme can be distinguished, therefore, from the functionally identical desoxyribonucleases derived from other sources. It may be noted, also, that the desoxyribonuclease inhibitor of yeast[4] and the Group A streptococcal desoxyribonuclease inhibitor do not show cross inhibition, *i.e.*, each inhibitor is specific for its own enzyme.

The inhibitor is stable to brief heating between pH values of 5.0 and 9.0, but is rapidly destroyed when heated in the presence of N/10 HCl or N/10 NaOH. The inhibitor is non-dialyzable and it is not affected by shaking with $CHCl_3$. It was inferred from these, and other, properties that the inhibitor is a nucleic acid, and the inference was borne out by the discovery that minute amounts of pancreatic ribonuclease specifically destroy the inhibitor, and by the observation that partially purified preparations of streptococcal ribonucleic acid markedly and specifically inhibit the Group A desoxyribonuclease.

There arises, finally, the question of whether ribonucleic acids obtained from other sources than streptococci are also capable of inhibiting the desoxyribonuclease of Group A streptococci. For this purpose, ribonucleic acids have been prepared from diverse starting materials, including animal, plant and bacterial cells, and each has been tested for its capacity to inhibit the streptococcal desoxyribonuclease. The results, as yet incomplete, show that the ribonucleic acids obtained from higher plants and animals fail to inhibit, while crude or purified preparations of ribonucleic acids, derived from a variety of bacterial species, inhibit the enzyme.[5] The observations provide a new character for the differentiation of ribonucleic acids, and they may be of some interest to comparative biochemistry.

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THE ACTION OF STREPTOCOCCAL DESOXYRIBONUCLEASE (STREPTODORNASE) ON PURULENT EXUDATES*

By SOL SHERRY†

During the course of observations, with Tillett, on the effect of injections of purified streptokinase preparations on areas of suppuration, it was noted that a rapid and dramatic lysis of thick viscous purulent exudates occurred. Biochemical studies revealed that the physical characteristics of thick viscous exudates were not due to fibrin but to some other constituent present in large amounts in the sediment of the exudate. The rapid lysis of thick exudates by the streptococcal enzyme concentrate suggested the presence of another significant enzyme in the preparation.

In 1948, we identified desoxyribonucleoprotein, henceforth referred to as DNP, as a significant constituent of the sediment of purulent exudates.[1] This viscous, stringy, insoluble protein, the major constituent of nuclear material, was found to comprise 30–70 per cent by weight, and 20–50 per cent by nitrogen, of the solid sediment of a series of thick, purulent exudates. The new enzyme present in the streptokinase preparation, capable of causing the rapid breakdown of this nucleoprotein, was identified as streptococcal desoxyribonuclease which, for simplicity, has been abbreviated to streptodornase.[2] The action of streptodornase was found to be on the desoxyribonucleic acid or DNA portion of the DNP.

Distribution and Significance of DNP in Purulent Exudates. When the Feulgen stain, which is specific for polymerized DNP, was applied to a series of smears of purulent exudates, it was possible to study the distribution and extent of accumulation of DNP. The DNP in purulent exudates was found to be present in the nuclei of the living and dead cells, and scattered extracellularly. In acute and subacute empyemas, the extracellular DNP appeared as granules and short fibrous strands. In chronic tuberculous empyemas, the DNP had polymerized into an extensive extra-

* This paper was presented as the third of five papers in the Symposium on Streptococcal Enzymes held by the Section of Biology on December 10, 1951.

† The May Institute for Medical Research of The Jewish Hospital Association, Cincinnati, Ohio.

‡ Two papers, "The Lysis in Rabbits of Intravascular Blood Clots by the Streptococcal Fibrinolytic System (Streptokinase)" by Alan Johnson and William S. Tillett, and "Streptococcal Hyaluronidase," by Karl Meyer, were presented as the fourth and fifth papers of the Symposium on Streptococcal Enzymes at the meeting of the Section of Biology on December 10, 1951. Their abstracts had not been received prior to the publication of this issue of the TRANSACTIONS.

cellular framework. The DNP was found to be the major factor responsible for the viscosity of thick purulent exudates, and represented a significant portion of the sediment.

Biochemical studies of the pus supernatant revealed the presence of a partially depolymerized DNP which could be extracted by hot trichloracetic acid, but was not cold acid soluble. The concentration of this material in the supernatant of an exudate could be correlated with the amount of extracellular DNP in the sediment.[3] Observations relating to the accumulation of DNP in purulent exudates revealed that, in areas of suppuration which were draining poorly, DNP accumulates extracellularly as degenerating cells disintegrate. Subsequently, part of the extracellular DNP is solubilized in the pus serum.

The streptodornase in our preparations acted in dramatic fashion on the DNP of purulent exudates, both in the test tube and in the patient.[4] When areas of chronic suppuration with thick purulent exudates were injected *in vivo* with streptococcal concentrates, thin purulent fluid could be readily aspirated within a matter of minutes. Feulgen stains revealed the rapid disappearance of all the extracellular DNP, with only the nuclei of intact cells still taking the stain.[5] Detailed studies by Johnson have revealed that these streptococcal enzymes are not toxic to the living cell but will rapidly dissolve the nucleus of degenerating dead cells as well as all extracellular DNP.[6]

The Extent of Degradation of DNP in vitro by Streptodornase. Preliminary studies of the action of streptodornase on purified DNA have demonstrated a rapid depolymerization, with the liberation of large amounts of acid soluble phosphorus, similar to the action of pancreatic DNASE.[5] However, it was found, when large amounts of enzyme concentrate were employed *in vitro*, that a considerable part of the available phosphorus of purified DNA, or of pus, was liberated as inorganic phosphorus. This implied a splitting of the DNA in whole, or in part, below the mononucleotide stage.

The extent of this degradation was then studied by paper chromatography employing methods and modifications developed by Chargaff, Hotchkiss, Marshak and Carter.[7,8,9,10] With the solvents employed, nucleosides and free purine and pyrimidine bases could be accurately identified in one one-hundredth of a milliliter of fluid. No preliminary purification or isolation was necessary prior to chromatography. The individual nucleosides, pyrimidine, and purine bases were visualized in the ultraviolet as dark-absorbing spots. Each spot was identified by its RF value, and, after elution from the paper, by its complete ultraviolet absorption spectrum in tenth normal acid and alkali.

The results of these studies indicated that the enzymatic degradation of purified DNA by streptodornase resulted in the final formation of guanine and adenine (the free purine bases), and cytidine and thymidine (the desoxypyrimidine nucleosides).[11] Streptodornase apparently contains a DNA depolymerase, a desoxypolynucleotidase, a desoxynucleotidase, and a desoxypurine nucleosidase. This is not an unreasonable viewpoint when one considers the various types of cleavages involved in releasing free purine bases from DNA. It is further substantiated by the observation of differences in pH and Mg ion concentration optima for depolymerase and nucleotidase activity of the streptococcal concentrate.

By using ribose mononucleotides as substrates, we have also been able to demonstrate that sterile purulent exudates removed from the thorax contain a nucleotidase, nucleosidases, and deaminases. Although a nucleotidase has been consistently found, the presence of specific nucleosidases and deaminases have varied with the exudate studied.

In vitro studies of the extent of the streptodornase degradation of DNA in purulent exudates revealed that the final end-products represented the combined action of the streptodornase, and the enzymes present in the exudate itself. Thus, the nucleosidases and deaminases present in some of the exudates studied were able to degrade the desoxypurine nucleosides to hypoxanthine, and the desoxypyrimidine nucleosides to uracil and thymine.

The Effect in Patients of Streptodornase on Thick Purulent Exudates. The changes produced by streptodornase on purulent exudates in patients were found to contribute very significantly to the development of the concept of streptococcal enzymatic debridement[12] and can be summarized as follows: (1) gross lysis of thick purulent exudates; (2) disappearance of all the extracellular DNP (Feulgen stain) of purulent exudates; (3) a striking decrease in the viscosity of thick purulent exudates; (4) a striking decrease in the per cent

sediment of thick purulent exudates; (5) a sharp rise in the organic acid soluble phosphorus and acid soluble nitrogen concentration in the supernatant of the exudate; (6) no increase in inorganic phosphorus or uric acid concentration in the supernatant of the exudate; and (7) a striking decrease in the number of degenerated cells of the exudate with no demonstrable morphologic damage to living cells.

The changes were demonstrable to a significant degree within one hour following the injection of streptodornase. Following a single dose, they continued for varying periods of time ranging from several hours to several days but were self-terminating.

No chromatographic studies have been made of the nature of the end products occurring *in vivo* as a result of DNP degradation by streptodornase. From the biochemical data available on patients with empyema, the streptodornase degradation of DNP *in vivo* does not appear to proceed further than the nucleotide stage, since the latter are rapidly absorbed from the site of disease.[5]

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4. Tillett, W. S., & S. Sherry. 1949. The effect in patients of streptococcal fibrinolysin (streptokinase) and streptococcal desoxyribonuclease on fibrinous, purulent, and sanguineous pleural exudations. J. Clin. Invest. **28:** 173.
5. Sherry, S., A. Johnson, & W. S. Tillett. 1949. The action of streptococcal desoxyribose nuclease (streptodornase) *in vitro* and on purulent pleural exudations of patients. J. Clin. Invest. **28:** 1094.
6. Johnson, A. J. 1950. Cytological studies in association with local injections of streptokinase-streptodornase into patients. J. Clin. Invest. **29:** 1376.
7. Vischer, E., & E. Chargaff. 1947. The separation and characterization of purines in minute amounts of nucleic acid hydrolysates. J. Biol. Chem. **168:** 781.
8. Hotchkiss, R. D. 1948. The quantitative separation of purines, pyrimidines, and nucleosides by paper chromatography. J. Biol. Chem. **175:** 315.
9. Marshak, A., & H. J. Vogel. 1950. Quantitative microanalysis of nucleic acid purines and pyrimidines without prior isolation of the nucleic acids. Federation Proc. **9:** 85.
10. Carter, C. E. 1950. Paper chromatography of purine and pyrimidine derivatives of yeast ribonucleic acid. J. Am. Chem. Soc. **72:** 1466.
11. Sherry, S. & J. P. Goeller. 1950. The extent of the enzymatic degradation of desoxyribonucleic acid (DNA) in purulent exudates by streptodornase. J. Clin. Invest. **29:** 1588.
12. Tillett, W. S., S. Sherry, L. R. Christensen, A. J. Johnson, & G. Hazelhurst. 1950. Streptococcal enzymatic debridement. Ann. Surg. **131:** 12.

CONFERENCES HELD

SECTION OF BIOLOGY

"THE CHICK EMBRYO IN BIOLOGICAL RESEARCH"

DECEMBER 7 AND 8, 1951

The Section of Biology held a Conference on "The Chick Embryo in Biological Research." Doctor David A. Karnofsky, Sloan-Kettering Institute for Cancer Research, New York, N. Y. and Doctor Mary E. Rawles, The Johns Hopkins University, Baltimore, Md. were the Conference Chairmen in charge of the meeting.

The program consisted of the following papers:

Friday, December 7

Morning Session. Chairman, Nelson T. Spratt, Jr.

Introductory Remarks—Eli D. Goldsmith, Office of Naval Research, New York, N. Y.

"Metabolism of the Early Embryo," Nelson T. Spratt, Jr., University of Minnesota, Minneapolis, Minn.

"Metabolic Patterns During Later Embryonic Development," Milton Levy, New York University College of Medicine, New York, N. Y.

"The Differentiation of Enzymes in Relation to the Functional Activities of the Developing Embryo," Florence Moog, Washington University, Saint Louis, Mo.

"Appearance of Tissue-Specific Proteins During Development," James D. Ebert, Indiana University, Bloomington, Indiana.

"Physical and Chemical Changes in the Blood Stream," A. M. Schechtman, University of California at Los Angeles, Los Angeles, Calif.

"Development of Muscle," Heinz Hermann, University of Colorado, Denver, Colo.

Afternoon Session. Chairman, Mary E. Rawles.

"Development of the Digestive Tube and its Derivatives," Dorothea Rudnick, Albertus Magnus College and Yale University, New Haven, Conn.

"Development of the Central Nervous System," Viktor Hamburger, Washington University, Saint Louis, Mo.

"Functional Persistence of Embryonic Determinations in Feathers and Late Developmental Stages in Spurs," Mary Juhn, University of Maryland, College Park, Md.

"Development of the Excretory System," Peter Gruenwald, State University of New York, New York, N. Y.

"Development of Adrenal-Pituitary Relationships," James F. Case, Bureau of Animal Industry, United States Department of Agriculture, Beltsville. Md.

"The Development of Sex Hormone Activity of the Gonad," B. H. Willier, The Johns Hopkins University, Baltimore, Md.

Evening Session. Chairman, Edgar Zwilling.

"Genetic Control of Normal Development," Walter Landauer, The University of Connecticut, Storrs, Conn.

"Sensitive Periods During Development," Howard L. Hamilton, Iowa State College, Ames, Iowa.

"Vitamin Deficiencies and Antagonists," W. W. Cravens, The University of Wisconsin, Madison, Wis.

"The Effects of Some Hormones on Development," Edgar Zwilling, The University of Connecticut, Storrs, Conn.

"Metallic Salts," Lois P. Ridgway, Sloan-Kettering Institute for Cancer Research, New York, N.Y.

"The Effects of Radiation on the Chick Embryo," Frank J. Dixon, The University of Pittsburgh School of Medicine, Pittsburgh, Pa.

Saturday, December 8

Morning Session. Chairman, Frank L. Horsfall, Jr.

"Endogenous Viruses in the Egg," George Cottral, Regional Poultry Research Laboratory, East Lansing, Mich.

"Virus Growth in the Chick Embryo," Herald R. Cox, Lederle Laboratories, Pearl River, N. Y.

"Pathological Effects of Viruses on the Embryo," G. John Buddingh, Louisiana State University School of Medicine, New Orleans, La.

"Effects of Virus Growth of Embryo Metabolism," Donald Greigg, Saint Louis University School of Medicine, Saint Louis, Mo.

"Modification of Virus Multiplication in the Chick Embryo," Harold S. Ginsberg, Western

Reserve University School of Meidcine, Cleveland, Ohio.

"Chemotherapy Trials in the Chick Embryo," I. W. McLean, Jr., Parke, Davis & Company, Detroit, Mich.

"Bacterial and Myotic Infections of the Chick Embryo," G. John Buddingh, Louisiana State University School of Medicine, New Orleans, La.

Afternoon Session. Chairman, David A. Karnofsky.

"Membrane Growth and Function," Alexis L. Romanoff, Cornell University, Ithaca, N. Y.

"Transplantation of Normal Tissues," Mary E. Rawles, The Johns Hopkins University, Baltimore, Md.

"Tumor Transplantation," David A. Karnofsky, Sloan-Kettering Institute for Cancer Research, New York, N. Y.

"Effect of Mouse Tumor Transplantation on the Nervous System," Rita Levi-Montalcini, Washington University, Saint Louis, Mo.

The Section of Biology provides conferences for active workers in the special fields of Biology.

Attendance is limited to those invited to participate in these conferences and to interested Members of the Academy.

NEW MEMBERS

A. Elected December 13, 1951

LIFE MEMBERSHIP

Lepine, Pierre Raphel, M.D., Biology, Epidemiology. Director of Virus Research Division, Institut Pasteur, Paris, France.

SUSTAINING MEMBERSHIP

Ferguson, George W.M., M.A., Biology. Assistant Professor of Biology, Georgetown University, Washington, D.C.

Steinberg, Charles Side, M.A., Education Communications. In charge, Educational Lectures, Warner Brothers, New York, N.Y.

ACTIVE MEMBERSHIP

Addelston, Lorraine W., M.A., Mathematics. Assistant to Principal, J.H.S.115, New York, N.Y.

Anderson, V., Pharmacology. Writer, Burroughs Wellcome & Co., Tuckahoe, N.Y.

Angelone, Luis, M.A., Physiology. Graduate Student, Ohio State University, Columbus, Ohio.

Angerer, Clifford A., Ph.D., Physiology. Associate Professor of Physiology, Ohio State University, Columbus, Ohio.

Auerbach, Stanley I., Ph.D., Zoology. Instructor in Biology, Roosevelt College, Chicago, Ill.

Ayre, James Ernest, M.D., Cytology & Cancer Research. Director, Dade County Cancer Institute, Miami, Fla.

Baker, Burton Lowell, Ph.D., Microscopic Anatomy, Endocrinology. Associate Professor of Anatomy, University of Michigan, Ann Arbor, Mich.

Baker, E.G. Stanley, Ph.D., Protozoology. Professor of Zoology, Drew University, Madison, N.J.

Barteaux, Miriam Marsh, B.A., M.S., Plant Physiology. Fairfax, Va.

Bedell, Harold, M.D., Internal Medicine. Private Practice, New York, N.Y.

Bernstein, Alan, B.S., Virology. Graduate Student, Philadelphia, Pa.

Bogart, Larry, Nutrition, Public Health. Public Relations Director, Sugar Research Foundation, New York, N.Y.

Botan, Edward Allen, M.S., Microbiology. Department of Microbiology, Boston University, Boston, Mass.

Brandwein, Paul F., Ph.D., Phytopathology. Chairman, Biological Science, Forest Hills H.S., Forest Hills, N.Y.

Brewster, Jr., William Russell, M.D., Anesthesia. Research Fellow in Anesthesia, Massachusetts General Hospital., Boston, Mass.

Buchanan, Donald L., M.D., Biochemistry. Associate Biochemist, Argonne National Laboratory, Chicago, Ill.

Buchsbaum, Ralph, Ph.D., Zoology. Professor of Zoology, University of Pittsburgh, Pittsburgh, Pa.

Campagnoli, Mario, M.D., Medicine, Public Health. Ministry of Public Health, Buenos Aires, Argentina.

Carter, Glenn Owen, B.S., Chemical Engineering. Consulting Engineer, Larchmont, N.Y.

Chowla, S., Ph.D., Number Theory. Mathematics Department, University of Kansas, Lawrence, Kansas.

Collins, Frank C., Physical Chemistry. Ph.D. Professor of Physical Chemistry, Polytechnic Institute, of Brooklyn, N.Y.

Collins, Gerald B., Ph.D., Orientation of Animals. Research Biologist, Seattle, Wash.

Conklin, Ruth E., Physiology. Professor of Physiology, Vassar College, Poughkeepsie, N.Y.

Cullen, Stuart C., M.D., Anesthesiology. Professor of Surgery, University Hospitals, Iowa City Iowa.

Dansereau, Pierre, D.Sc., Ecology. Assistant Professor of Botany, University of Michigan, Ann Arbor, Mich.

De Franciscis, Pietro, M.D., Physiology. Research Fellow, Department of Physiology, Yale University, New Haven, Conn.

Depetris, Joseph F., D.O., Internal Medicine. Chairman, Department of Internal Medicine, Dallas Osteopathic Hospital, Dallas, Texas.

Dixon, Frank J., M.D., Pathology. Professor Department of Pathology, University of Pittsburgh, Pittsburgh, Pa.

Eaton, Munroe D., M.D., Bacteriology. Associate Professor of Bacteriology, Harvard Medical School, Boston, Mass.

Eckhardt, Robert Edward, M.D., Industrial Hygiene. Medical Research Director, Esso Labs., Linden, N.J.

Freinkel, Norbert, M.D., Physiology. Medical Corps., Biophysics Section, Washington, D.C.

Furutani, Yaye, Ph.D., Biology. Research Bacteriologist, Veterans Administration Hospital, Chicago Ill.

Garlan, Samuel Arthur, M.D., Medicine. President of N.Y. State Academy of General Practice, New York, N.Y.

Generales, Jr., C.D.J., Ph.D., M.D., Cancer. Private Practice, New York, N.Y.

Gennaro, Jr., Joseph F., Ph.D., Developmental Physiology. Assistant Professor of Biology, St. John's University, Brooklyn, N.Y.

Granoff, Allan, M.S., Virology. Research Assistant, Children's Hospital, of Philadelphia, Pa.

Guthrie, Mary J., Ph.D., Cytology. Staff Member, Detroit Institute of Cancer Research, Detroit, Mich.

Gutowitz, Alan, M.S., Virology. Research Assist., Children's Hospital, of Philadelphia, Pa.

Hecht, Milton, Ph.D., Psychology, Biology. Teacher of Biology, Abraham Lincoln H.S., Brooklyn, N.Y.

Henle, Werner, M.D., Biology. Professor of Virology, University of Pennsylvania, Philadelphia, Pa.

Heyde, Martha Bennett, B.A., M.A., Psychology. Columbia University, New York, N.Y.

Hoyer, Horst, W., Ph.D., Colloid Chemistry. Research Chemist, Park Forest, Ill.

Hunt, Charlotte Alling, B.S., Biochemistry. Biochemist, Worcester Foundation for Experimental Biology, Shrewsbury, Mass.

Jurnove, Donald S., M.D., Surgery. Private Practice, New York, N.Y.

Karp, Mary, M.D., Anesthesiology. Director, Department of Anesthesia, Wesley Memorial Hosp., Chicago, Ill.

Lesh, James B., Ph.D., Protein Fractionation & Pituitary Hormones. Director of Biochemical Research, Armour & Co., Chicago, Ill.

Lutwak, Leo, Ph.D., Biochemistry. Biochemist, Brookhaven National Lab., Upton, L.I., N.Y.

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Mayberger, Harold W., M.D., Neonatal Pathology. Research Fellow in Pathology, Beth-El Hospital, New York, N.Y.

Morgan, Herbert R., M.D., Medical Microbiology. Professor of Bacteriology, University of Rochester, N.Y.

Morse, Anna, M.S., Histochemistry. Technical Associate in Biological Research, Harvard School of Dental Research, Boston, Mass.

Mullen, Francis Edward, D.V.M., Poultry. Private Practice, Harrisonburg, Va.

Murray, F. Jos., Ph.D., Bacteriology. Head, Dept. of Bacteriology, Wm. S. Merrell Co., Cincinnati, Ohio.

Napp, Myron B., M.S., Experimental Zoology. Teaching Fellow, Dept. of Biology, New York University, New York, N.Y.

Nelson, Russell M., M.D., Surgery. Resident in Surgery, University Hospital, Minneapolis, Minn.

Nyka, Walenty, M.D., Pathology. Pathologist, Lederle Labs., Pearl River, N.Y.

Opdyke, David F., Ph.D., Physiology. Head, Dept. of Physiology, Merck Inst., Rahway, N.J.

Pharmakis, Thomas L., B.A., Diagnostic Bacteriology, Immunology. Bacteriologist, St. Vincent's Hosp., Bridgeport, Conn.

Pinchot, G.B., M.D., Biochemistry, Microbiology. Asst. Professor of Microbiology, Yale University, New Haven, Conn.

Rappoport, Donald A., Ph.D., Biochemistry. Research Biochemist, Columbia University, New York, N.Y.

Renkin, Eugene M., Ph.D., Physiology. Assoc. Biologist, Brookhaven National Laboratories, Upton, L.I., New York.

Robbins, Edwin, B.A., Medicine. Senior N.Y.U., Bellevue Medical Center, New York, N.Y.

Robinson, Lucille B., B.A., Bacteriology, Immunology. Bacteriologist, V.A. Hosp., Washington, D.C.

Russ, Donald R., M.D., Pathology, Immunology. Asst. Dept. of Pathology, Chicago Medical School, Chicago, Ill.

Saunders, Leon Zlotnick, Ph.D., Vet. Pathology. Pathologist, Pathology Branch, Chem. Corps., Med. Labs., Army Chem. Center, Md.

Schiller, Sara, Ph.D., Endocrinology. Senior Biochemist, La Rabida Sanitarium, Chicago, Ill.

Seaman, Gerald R., Ph.D., Metabolism. Asst. Professor of Physiology, University of Texas, Galveston, Texas.

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Swienty, Wilhelm, M.D., Biology, Anthropology, Chemistry. Asst. Attending, Dept. of Gynecology & Obstetrics, St. Clare's Hospital, New York, N.Y.

Taylor, A.B., Ph.D., Physiology. Assoc. Professor of Physiology, Department of Physiology, Univ. of Illinois, Urbana, Ill.

Taylor, Clara Mae, Ph.D., Nutrition. Professor of Nutrition, Columbia Univ., New York, N.Y.

Taylor, D. Jane, M.S., Biological Sciences. Parasitologist, National Institutes of Health, Bethesda, Md.

Taylor, T. Ivan, Ph.D., Physical & Analytical Chemistry. Professor of Chemistry, Columbia Univ., New York, N.Y.

Tonna, Edgar Anthony, B.S., Cellular Physiology. Med. Technologist, Williamsburg General Hospital, Brooklyn, N.Y.

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Venet, Louis, M.D., Surgery, Cancer Research Asst. Director, Strang Cancer Clinic, Memorial Center, New York, N.Y.

Waly, Adnan, Ph.D., Physics. Chief Physicist, Electronized Chemicals Corp., New York, N.Y.

Weyl, Simon, M.D., Psychology. Private Practice, New York, N.Y.

Wills, Franklin K., D.V.M., Poultry Pathology. Asst. Poultry Pathologist, State Board of Agriculture, Dover, Del.

Wilson, Philip D., M.D., Orthopaedic Surgery. Surgeon in Chief, Hosp. for Special Surgery, New York, N.Y.

Wright, Claude-Starr, M.D., Hematology. Asst. Professor of Medicine, Dept. Medicine, Ohio State Univ., Columbus, Ohio.

STUDENT MEMBERSHIP

Davidson, Barbara Alice, B.A., Cultural Anthropology. Student, Columbia Univ., New York, N.Y.

Ginsberg, Arthur, M.A., Psychology. Student, New York University, New York, N.Y.

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Jensen, Senta Hella, B.A., Speech Pathology, Medicine. Student in Speech, Medical Dept., State Univ. of N.Y., Brooklyn, N.Y.

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